

ART 34 AMDT

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CLAIMS

1. A mass spectrometer comprising:
means (1) for generating ions from a sample introduced
5 into a plasma;
a sampling aperture (2) for transmitting some of the
ions into an evacuated expansion chamber (3) along a first
axis (9) to form an ion beam;
a second aperture (5) for transmitting some of the ion
10 beam into a first evacuated chamber (6);
a first pump (7) for maintaining the first evacuated
chamber (6) at high vacuum;
a first ion optical device (17) located in the first
evacuated chamber (6) for containing the ion beam;
15 a third aperture (19) for transmitting the ion beam
into a second evacuated chamber (20);
a second pump (21) for maintaining the second
evacuated chamber (20) at a lower pressure than the first
evacuated chamber (6);
20 a collision cell (24) having an entrance aperture (27)
and an exit aperture (28) and pressurized with a target gas
(26), the collision cell (24) being disposed in the second
evacuated chamber (20);
a second ion optical device (25) located in the
25 collision cell (24) for containing the ion beam;
a fourth aperture (32) for transmitting the ion beam
into a third evacuated chamber (33) containing mass-to-
charge ratio analysing means (37) disposed along a second
axis (36) for mass analysing the ion beam to produce a mass
30 spectrum of the ion beam; and,
a third pump (39) for maintaining the third evacuated
chamber (33) at lower pressure than the second evacuated
chamber (20).
- 35 2. A mass spectrometer according to claim 1, wherein the
first evacuated chamber (6) is maintained at a pressure of
approximately 10^{-2} to 10^{-4} mbar.

3. A mass spectrometer according to claim 1 or 2, wherein the first evacuated chamber (6) is maintained at a pressure of approximately $1-2 \times 10^{-3}$ mbar.
- 5 4. A mass spectrometer according to any one of the preceding claims, including a gap of at least 2 cm between the third aperture (19) and the entrance aperture (27) of the collision cell (24).
- 10 5. A mass spectrometer according to any one of the preceding claims, wherein the distance between the ion source (1) and the entrance aperture (27) of the collision cell (24) is 90 to 200 mm.
- 15 6. A mass spectrometer according to any one of the preceding claims, wherein the mass-to-charge ratio analysing means (37) includes a main mass filter which preferably is an RF quadrupole.
- 20 7. A mass spectrometer according to any one of the preceding claims, wherein the first ion optical device (17) is a mass selective device.
- 25 8. A mass spectrometer according to any one of the preceding claims, wherein the first ion optical device (17) is an RF quadrupole.
- 30 9. A mass spectrometer according to any one of the preceding claims, wherein the second ion optical device (25) is an RF quadrupole.
- 35 10. A mass spectrometer according to any one of the preceding claims, wherein the second ion optical device (25) is mass selective.
11. A mass spectrometer according to any one of the preceding claims, wherein the second axis (36) of the mass

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to charge ratio analysing means (37) is offset from the first axis (9).

12. A mass spectrometer according to any one of the preceding claims, wherein the first evacuated chamber (6) is divided into a first region (14) adjacent to the expansion chamber containing an extractor lens (8) driven at a negative potential, and a second region (15) adjacent to the collision cell (24) in which the ion optical device (17) is located, by a large diameter aperture (11) and the aperture is sealable by means of a flat plate (12) on an O-ring seal (13).